4:Grajdanzev--108 S-4 (no date) 1942 Formosans
116, 135, 316

"Gold mining was carried on in Taiwan before the Japanese occupation, but gradually, as the best areas were worked out, the amount of gold produced declined and remained low up to 1931, when the depreciation of the yen and the consequent rise in the price of gold made mining more profitable. At the same time the introduction of machinery in modern enterprises decreased costs and, as a result, in five years (1931-36) the value of gold produced was tripled. Since 1936 no data have been published, though the discovery of new ore deposits was mentioned in the newspapers (1). Placer gold is mined in

1. In the February 1940, issue, of Keizai Chishiki it is reported that in October 1939, in the eastern part of the island in the valley of the Takkiri (Keikoku), placer gold was discovered by a mining engineer. This placer deposit was estimated to contain one billion yen worth of gold. However, as early as 1907 Yokobori estimated the value of gold in placers and ores in Taiwan at four billion yen.

Taihoku and Karenko provinces, while ores containing gold in conjunction with silver and copper are found only in Taihoku province."

4:Grajdanzev--108 [21 S-4 (no date) 1942 Formosans
116, 135

"Coal is produced in two northern provinces only—Taihoku and Shinchiku. It is low-grade bituminous coal with heating power varying from 7,480 to 6,160 calories and with a sulphur content of 1.2 per cent to 4.45 per cent. One field in Taihoku contains as much as 64.8 per cent of volatile matter. The layers are from two to three feet thick, and reserves are estimated to amount to 400 million tons. This is less in proportion to the population than in Japan, but considerably more than in the Philippines. Only a part of island is geologically surveyed, so it may be that the estimate will be altered after the resources of the island have been more fully investigated."

4:Grajdanzev--109 S-4 (no date) 1942 Formosans
116, 135, 315, 382, 177.31 Japan
636.31

"Since 1908 the Taiwan government-general and the Japanese navy have paid special attention to oil production in Taiwan, but up to now this branch of mining has been more productive of subsidies to oil producers than of oil itself. It was mentioned above that in 1936 the value of oil produced in Taiwan was ¥312,000 and that of gasoline, ¥456,000. However, in the 1937 budget of the government-general ¥1,005,000 was earmarked as subsidies for oil producers and prospectors. Daily production of oil in the last few years has been about 5,000 American gallons."

4:Grajdanzev--109 [21 S-4 (no date) 1942 Formosans
116, 135, 171, 315, 354

"From the local point of view the production of natural gas is more important[than that of oil--analyst]. The region richest in gas is Kinsui in Shinchiku province, and the gas is used for the production of benzine and carbon-black, as a fuel for sugar mills, and for domestic use. However, in 1937 only 7,411 families had gas facilities (as compared with 2,233,136 in Japan proper)."

4:Grajdanzev--109-110 S-4 (no date) 1942 Formosans
116, 135, 315

"Recently manganese ore was discovered in eastern Taiwan and plans were pushed for the production of magnesium from [110] sea water, but no concrete data are available as to the character of the deposits or the output."

6: Kirchhoff--26-27 U-4 (no date) 1895 Formosans
116, 133, 135

Slight and fragmentary is our knowledge of the soil composition and the geology of Formosa. The two coastal mountains at the mouth of the Tam-sui are trachytic, and the proof of considerable recent variations in elevation is given by layers of pebbles and mussel breccia on its slopes high above the actual sea level. The Ki-lung Range consists of sandstone with intercalations of extensive coal beds. The presence of Miocene and Pliocene Tertiary formations has also been shown, and particularly in the north of the island recent, indeed continuing volcanic activity. It still remains to be examined how much faith can be set on Chinese reports of "nightly gleams of fire" as phenomena of volcanic eruption, even in the mountains of the southeast. But Formosa, beyond any doubt, belongs to the great Eastern Asiatic Belt with still persisting volcanic phenomena. Deposits of sulphur and solfataras are found in considerable numbers in northern Formosa; in many places there steam forces its way hissing out of the ground, generally mixed with sulphur gases, at times as a steam hole. In addition to genuine geysers, [27] steam holes send up white pillars of vapor to a height of 8 to 10 meters from the fissures of the Tschao-soan.

6: Kirchhoff--33 [5] U-4 (no date) 1895 Formosans
116, 135, 317

Among the minerals, there should first be mentioned the sulphur of North Formosa. The sulphur is broken into blocks or it is cut out of sulphurous earth by melting.

Petroleum is obtained in various spots, but is inferior. According to old Dutch chroniclers, gold was formerly mined in the northeast; it is also said that, in the trenches dug to receive it, quantities of gold were obtained at the foot of the hills in this region, when the August rains had swelled the rivers. The river of Su-aô actually carries down from the mountains particles of gold in the sand. Other regions of the island have also proved to contain gold recently. Thus, in the southern part of the country, near Liang-tschian (within the territory still left to the natives), a landslide caused by heavy rains is said to have revealed a considerable quantity of gold. Most surprising was the discovery of goldbearing river sand while building a railroad bridge over a tributary of the upper Ki-lung, in 1890. At once thousands of Chinese hastened thither who had learnt goldwashing in California or Australia; and in the course of the last years the stones carried down by the Ki-lung have been most industriously exploited by these goldwashers, and it would appear with considerable success. But in the fixed rock no gold has been discovered there (Hosie, pp. 23 ff.).

But much greater profit is promised by the extraction of coal, which is met with far and wide in extensive beds, both in north and south (Hosie, p. 21). Up till now the only extraction of importance has taken place in the beds that can be traced along the northeast coast, on the right side of the Ki-lung River, through the Ki-lung Mountains as far as the mountain spurs of Pi-taô. The coal mines there lie close to the coast near

the port of Ki-lung, and provide, in part, a very good anthracite; formerly the coal was extracted only in Chinese fashion in galleries that sank diagonally, but since 1875 machines have been used.

9: Yamasaki--223 [2] N-5 (1896-1897) 1900 Formosans
116, 133, 135, 314

It is worthy of note that the wealth of the island depends chiefly on the Tertiary mountains. The most important minerals, such as gold, soft coal and petroleum, are found here. The camphor trees also grow in this region, for the most part.

9: Yamasaki--224 [3] N-5 (1896-1897) 1900 Formosans
116, 133, 135, 529

In the valley of Kōkei, between the three volcanoes described above, there is a large solfatara. It is situated exactly on the border between the volcano and the Tertiary hill whose slopes rise very steeply opposite the former and rather gently on the other side. Here we are doubtless confronted with a break in the Tertiary range through which the solfatara made its way. It has a considerable area, and many people work there gathering sulphur. Not far off there is a bog from which many hot sulphur springs rise. These springs flow out through a gulley and form a cheerful brook with some water-falls, and here a spa has been built. The surroundings of the Hokuto spa are very pleasant and attractive, and it is now the favorite recreation center for the citizens of the capital of Taihoku, who can reach it after a journey of one and one half hours.

9: Yamasaki--228 N-5 (1896-1897) 1900 Formosans
135

Along the upper course of the Tamsui-kei river there are gold fields and bituminous coal deposits.

9: Yamasaki--233 [7] N-5 (1896-1897) 1900 Formosans
116, 135, 175

Important minerals found in Taiwan are gold, coal and sulphur. The chief sites are in North Taiwan, particularly in the surroundings of Kilung. Gold is found in two form as river-gold and in veins. It was first dound in Kilung-kei in 1890 by a Chinese workman who had formerly been in a Californian mine and who was occupied in constructing a railroad bridge over the river. From this time on, thousands of gold-washers have visited a long stretch of the Kilung-kei about 16 km. from its upper course at the Sanshōrei to the Shichito railroad bridge. Later gold deposits were also discovered in the mountains of Kyūfun-san and Kinkaseki, in the Zuihō region lying to the east of the port of Kilung. We learn through Dr. Ishii, the Taiwan Government geologist, that the met is found in Kinkaseki in the zone of contact between Tertiary layers, in the main sandstone and slate, and the projecting volcanic rock, while in Kyūfun-san there are veins that are traversed by Tertiary layers. In addition gold-bearing sand was also found near Shinjō and in the Shūkoran-kei on the east coast.

9: Yamasaki--233-234 N-5 (1896-1897) 1900 Formosans 116, 135

There is a good deal of coal in the Tertiary Kilung mountainous region; but unfortunately its quality in general is not good. Many deposits can be seen on either side of the Kilung-kei. Denryōkō, Shikyakutei and Sanshōrei are the chief centers in this region, and here the quality of the coal is good compared with other places. There are three deposits in Shikyakutei, the thickest of which measures [234] 1.3 m. The Denryōkō deposits also consist of three beds, the thickest being 3 m.; but they gradually become narrower towards the west. To the north of this region are found the Nai and Gaihoku-san, the Kakyaku and Kimpoli deposits, among which the Kakyaku fields belonging to the Imperial Navy have four deposits, the thickest of these being about 1.7 m. The continuation of the northern layers stretches out farther to the west in Kilon, on the table-land of Tōshiyen, while continuations of the Sanshōrei layers can be found only near Shinten to the south of Taihoku. The coal-bearing layers are always Tertiary sandstone and slate, as in other regions of Japan, and their line of strike goes from the northeast to the southwest. There are anticlinal and synclinal layers, and their angle of descent is often very great, being as much as 85°.

9: Yamasaki--234 N-5 (1896-1897) 1900 Formosans
116, 135

Sulphur comes from various solfataras in the Taiton volcanic group,...For the most part it comes from the large solfataras of Hokutō (Patau), Dairyūkō on the western declivity of the Shichiseiton-san, and Taikōshi, to the south of Kimpoli. The other five solfataras also yield small quantities. The total production varies between 300,000 and 420,000 kilograms annually.

9: Yamasaki--234 [2] N-5 (1896-1897) 1900 Formosans
116, 135

Petroleum. It is known to occur in various places. In Gyūtōkō, 15 km. to the southeast of Byōritsu (Mioli), where the middle course of the Kōrō-kei forms a gorge through the chain of Tertiary layers, it appears on its bank. Formerly 36 kilograms were obtained here every day. In addition it is found in two wells in South Taiwan, near Kōnaishō and Hōryō, 12 km. to the north of Banshoryō.

10: Schumacher--225 [10] T-1 (ca. 1896) 1898 Formosans
116, 135, 214, 823

In the north of Formosa, sulphur is cut in large blocks. In the center of the island (Kagee) considerable coal seams are found and the same is true of the northern region around Kelung. The Su-ao river carried gold dust together with rubble as it flows down from the mountains, but the Chinese do not attribute special importance to the gold of the stream. Their interest in camphor is much greater.

Kelung is important because it is near some coal deposits; it and Port-Coal which lies several kilometers to the east are the ports of embarkation for the mineral.

These deposits are about one league east of the city and about two kilometers south of the villages of Gia-Kow and Petao in the mountainous massif which borders the Kelung basin on this side.

The enormous elevation of the plateau is almost completely carboniferous. Coal comes practically to the surface and in certain spots you find it as soon as you begin to scratch the vegetable surface.

31: Hofmann--604 N-3 (1909) 1912 Formosans
116, 135

In the vicinity of Taihoku, the most interesting features are the harbor of Tamsui and the Onsen sulphur springs near Hokuto. From there we went on an expedition which was to take us to the extreme boundaries of that section of the mountain region which could still be considered fairly safe.

37: Steere--316 [1] S-3 (1873-74?) 1875 Formosans
116, 135

"The beds of coal which is found in great abundance at Kelung, at the north end of the island, are apparently in these superficial strata of sandstone. There has been considerable volcanic disturbances toward the north end of the island, and there are large boiling springs of mineral water and jets of steam bursting out in a valley a few miles east of Tamsni. Sulphur is deposited in great quantities, and the Chinese have manufactured it at some time. Petroleum is found flowing from the earth near Onlau toward the north end of the island, and we saw signs of coal on our way out from Posia to the east of Changwha. Gold is said to exist in the island, but this does not seem to be authenticated. There is a curious outcrop of limestone at Takao, near the south end of the island, comprisihg Ape's-hill, Whale's-back, and several smaller ridges connecting these and extending them. The dip of this outcrop is toward the southeast, almost opposite to the general dip of the strata in that part of the island. The rock is a porous limestone with many eaves and crevices in it. There is much fossil coral and a few shells that appear to be of the same age as those found in the sandstone. Whale's-back is thrown up at an angle of about 45° in a great level plain of alluvium, and appears like a great broken piece of ice that has been thrown up and frozen fast in its place."

42: Schetelig--386 T-2 (no date) 1868 Formosans
116, 135, 501, 505

I decided to visit Kilung first. On the journey thither by water we saw the now celebrated sulphur springs in the so-called Hell Valley. In addition to the plentiful sulphur springs, they have high pressure water vapor impregnated with SH, and also bring up a mass of clay similar to the contents of the mud volcanoes. From this the Chinese obtain large quantities of sulphur by simply boiling it off. The surroundings of the river become ever more beautiful once one has left the broader part of the lower Tamsui course and has passed through the so-called Manka Plain (Manka is the name of the chief town of the district of Tamsui-Ting). Gently rising and luxuriantly coated clay schist hills come down almost to the river bed, while in the distance picturesquely grouped and precipitous sandstone mountains offer a varied picture to the eye. But soon hard work is called for, for the rapids, which now occur in great numbers, can be passed only with difficulty and our crew stand up to their shoulders in water to shove the loaded vessel over the pebbles, while the traveler must also quite frequently jump out in order to lighten the boat and to help. Other boats sweep down past us at a great speed for the most part laden with hemp, indigo, potatoes or coal. On the seaward journey the force of the water does all that is necessary, and the skillful Chinese has equipped the boat only with a rudder at the back and, remarkably enough, in front also, in order to steer round the rocks without danger. Before coming to Kilung one crosses the watershed, a small height of some 200 to 300 feet, which sinks sharply towards Kilung and the sea.

42: Schetelig--386-387 T-2 (no date) 1868 Formosans
116, 135, 177, 361, 439

Kilung is a Chinese town with walls and gates. It is open to European commerce and is distinguished for the by no means inconsiderable beds of coal in the neighborhood and by the traces of a Spanish fort. For as, in the south near Taiwan-fu and in the north near Tamsui, quite substantial remains of Dutch strongholds are to be found, similarly the Spaniards, [387] during their brief period of settlement in the 17th century, seem to have made Kilung the chief point for their operations.

42: Schetelig--392-393 T-2 (no date) 1868 Formosans
116, 135, 314, 433

Among the products of the country I mention those of special interest for Europeans; coal, camphor and sulphur, for indigo and hemp are sent to the Chinese market only. No great quantities of sulphur are found, but more could be obtained nevertheless by the improvement of the methods used. Camphor alone makes a treasure chamber of the island of Formosa. It is known that the Laurus camphora is found only in Japan and Formosa, and there only in some districts. Since only trees of a particular age can be used for obtaining the valuable resin, and since every time, unfortunately, the whole tree with trunk and branches is thrown into the subliming pot, one can foresee a time when camphor will go up in price in geometric progression [393] and when finally production will become so small that not even Germany alone can be provided with it. This matter of camphor production seems to me to be of no means inconsiderable economic importance...

42: Schetelig--393 T-2 (no date) 1868 Formosans
116, 135, 316

Coal is found everywhere in narrow beds that are almost always horizontal and lie between graywack and clay schist. It is not of the first quality and is of light specific gravity, but when mixed with English or Australian coal it provides a fairly satisfactory fuel. Of the galleries I visited, some were 600 paces long before one reached dimensions of 6 to 7 feet vertically and 20 to 40 feet horizontally. Statements have also been made about precious metals that are said to occur in Formosa. I myself have seen nothing of the kind, but before all else I wish to stress the fact that the value of precious metals does not depend on their inherent worth alone, but on the location and the surroundings.

45:Stanford U. S-4, 5 1956 AD1 Formosa
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Annex "A," Subparagraph 3a',
Economic Background

GENERAL STRUCTURE OF ECONOMY

Two-thirds of Formosa is mountainous and one-third is lowland. The mountains are rugged and covered with dense forests, but most of the lowland is well suited to the production of commercial crops. Though the Tropic of Cancer passes through the island, its climate is mild, with moderate temperatures and abundant rainfall. Two major crops a year are usual and a third crop of vegetables often increases the total yield. The soils are generally fertile, but frequent inundation and heavy year-round cropping cause excessive leaching. To maintain fertility, large quantities of fertilizer become a necessity.[1]

135 Mineral resources do not appear to be abundant. However, since much of the mountainous regions has not been thoroughly

1. The application of fertilizer to riceland in Formosa averages 50 pounds per acre per crop. Chiao-min Hsieh and Alice Taylor, "Formosa" Focus, N. Y., April 1955, p. 5.

135 explored geologically, the situation with respect to mineral resources could be changed considerably in the future. Bitumous coal is abudant in the northern part of the island, and some high-grade coking coal has been recently discovered at Nanchuang near Miaoli. Large reserves of copper and sulphur and some gold veins are located in the northeast part of the Taipei area. Pyrites in limited quantities are mined in the north, primarily for use in the fertilizer industry. Limestone and glass sand are also available for building purposes. But such ores indispensible to industrial development as iron, bauxite, lead, zinc, tin, and magnestie[2] are scarce or non-existent on the island and must be imported. As much of the rock formation on the island is petroliferous, large oil and natural gas fields may be discovered in the future, but as yet petroleum finds and development have been insufficient to offset reliance on foreign sources of supply.

241 The economy of Formosa is essentially agrarian; although only one-fourth of the total land area is arable, most of the population is engaged in farming. Ever since the Dutch

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2. Mercury and manganese ores are found in the mountains near Yilan.

45:Stanford U. S-4, 5 1956 AD 1 Formosa
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II. MINERAL RESOURCES [16]

135 Although many of the mountainous areas in Formosa have not been fully explored, the island does not appear to be rich in mineral resources nor are those that are known available 328 in quantity. Formosa does produce coal, some 316 gold, copper, petroleum, salt pyrite, and 317 sulphur. Some coal and salt is exported. All of the other minerals are for domestic consumption. Smaller quantities of mercury, manganese, asbestos, mica, and gypsum are also produced. Bauxite, necessary for the aluminum industry, and gypsum, used in cement production, are imported, since they are not found in sufficient quantities on the island. 316 The production of the various mining industries 433 in 1953 and 1954 is given below.

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16. Statistical information in this section, unless otherwise specified, is in large part from Taiwan Economic Data Book, Vol. 3, Taipei, 1955, by Foreign Operations Administration, MIssion to China.

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PRODUCTION OF MINING INDUSTRIES 1953-54 */

	1953	1954
Coal (1,000 metric tons)	2,393	2,100
Crude petroleum (kiloliters)	2,830	5,571
Natural gas (1,000 cubic meters)	30,925	28,962
Sulphur (1,000 metric tons)	3	6
Pyrite (1,000 metric tons)	23	25
Gold (kilograms)	772	670
Silver (kilograms)	651	624
Copper (1,000 metric tons)	13	10
Salt (1,000 metric tons)	162	369
Gypsum (1,000 metric tons)	6	3
Mica (1,000 metric tons)	24	20

*/ China Annual 1954, Vol. 3, p. 48.

135 Estimated reserves of selected minerals are given in the following table. It would appear, from this brief survey, that Formosa possesses limited mineral resources and few of the mineral requirements of modern industry.

45:Stanford U. S-4, 5 1956 AD 1 Formosa
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ESTIMATED MINERAL RESERVES */
(In Metric Tons)

	Quantity	Area located	Content
Coal	670,000,000	Keelung, Taipei, Hsinchu, and Chunan	-
Gold ore	5,000,000	Keelung	Au at 3.1 grams/MT
Copper ore	5,900,000	Suao and Hualien	Au at 1.3 gr/MT Cu 0.72 %
Sulphur	700,000	Taipei	S 30-45 %
Pyrite	5,380,000	Keelung and Hualien	-
Manganese	300,000	Suao	Mn 24-35 %
Iron sands	200,000	Tanshin	-
Asbestos	90,000	Hualien	-
Dolomite	2,000,000	Hualien	18-24 %
Crude oil	89,000 (cu.meters)	Chhuangkeng, Chinshui, and Miaoli.	-

*/ FOA Mission to China, Taiwan Economic Data Book, Vol. 3, 1955; Bank of Taiwan, T'ai-wan chih Ti-hsia Tsu-yüan [Underground Resources of Taiwan], Taipei, 1950, p. 171.

A. Coal

135 316 The coal mines of Formosa form a belt, roughly northeast-southwest, in the northwestern section of the island. Although relatively abundant, the coal is generally low-grade bitumen; only a limited quantity is suitable for cooking purposes. Annual production is about 2,000,000 metric tons; the estimated total reserve is 670,000,000 metric tons, most of which is located near Taipei Basin. More than 80 per cent of the coal produced is for domestic consumption. The remainder is exported.

B. Petroleum

315 Crude oil production is limited, and supplying only about one per cent of the island's requirement. There are five refineries on the island; Kaohsiung Refinery is the largest. The other four refineries are small in scale, located near oil fields in Miaoli, Chuhuangkeng, Chinshui, and Chutung. Kaohsiung Refinery, equipped with three crude distillation units, one thermal cracking and reforming unit, and one vacuum distillation unit, as well as auxiliary plants, is capable of processing 25,000 barrels of crude oil a day. The principal products are motor gasoline, jet fuel, kerosene, diesel fuel, heavy fuel oil, and asphalt. Geology experts generally agree that Formosa has ample oil reserves for domestic needs. Further exploration and the drilling of additional wells will contribute to increased production.